

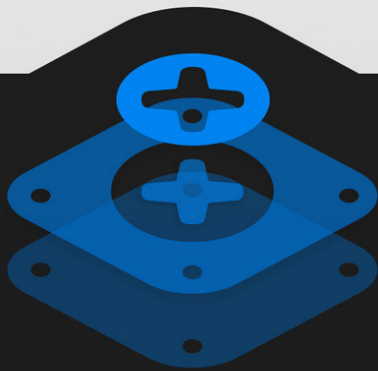


# Microsoft Surface Book Teardown

Microsoft Surface Book torn down on November 2, 2015.

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## Microsoft Surface Book



# TEARDOWN

## INTRODUCTION

Just last week we tore down the [Surface Pro 4](#), the tablet that can allegedly replace your laptop. Today we've got the Surface Book, a laptop that can, eh, replace the tablet that replaced your laptop. It's the first ever notebook from Microsoft, and with its trick detachable display and pressure-sensitive Surface Pen, it defies categorization—but not teardownification. Join us as we dismantle the Surface Book!

Teardown season is heating up—follow us on [Instagram](#), [Twitter](#), or [Facebook](#) for all the latest!

[video: <https://www.youtube.com/watch?v=DwNtqs6pRqk>]

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### TOOLS:

- [iOpener](#) (1)
  - [T3 Torx Screwdriver](#) (1)
  - [iFixit Opening Picks set of 6](#) (1)
  - [Tweezers](#) (1)
  - [T5 Torx Screwdriver](#) (1)
  - [Spudger](#) (1)
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## Step 1 — Microsoft Surface Book Teardown



- Just what is a "surface book"? We check the specs for clues:
  - 13.5" PixelSense multitouch display, with 3000 x 2000 resolution (267 PPI)
  - 6th Gen Intel Core i5 with dedicated NVIDIA GPU
  - 8 GB RAM
  - 128 GB solid-state drive
  - 802.11ac Wi-Fi + Bluetooth 4.0
  - 8.0 megapixel rear-facing camera with 1080p video + 5.0 megapixel front-facing camera
  - Surface Pen with 1,024 levels of pressure sensitivity

## Step 2



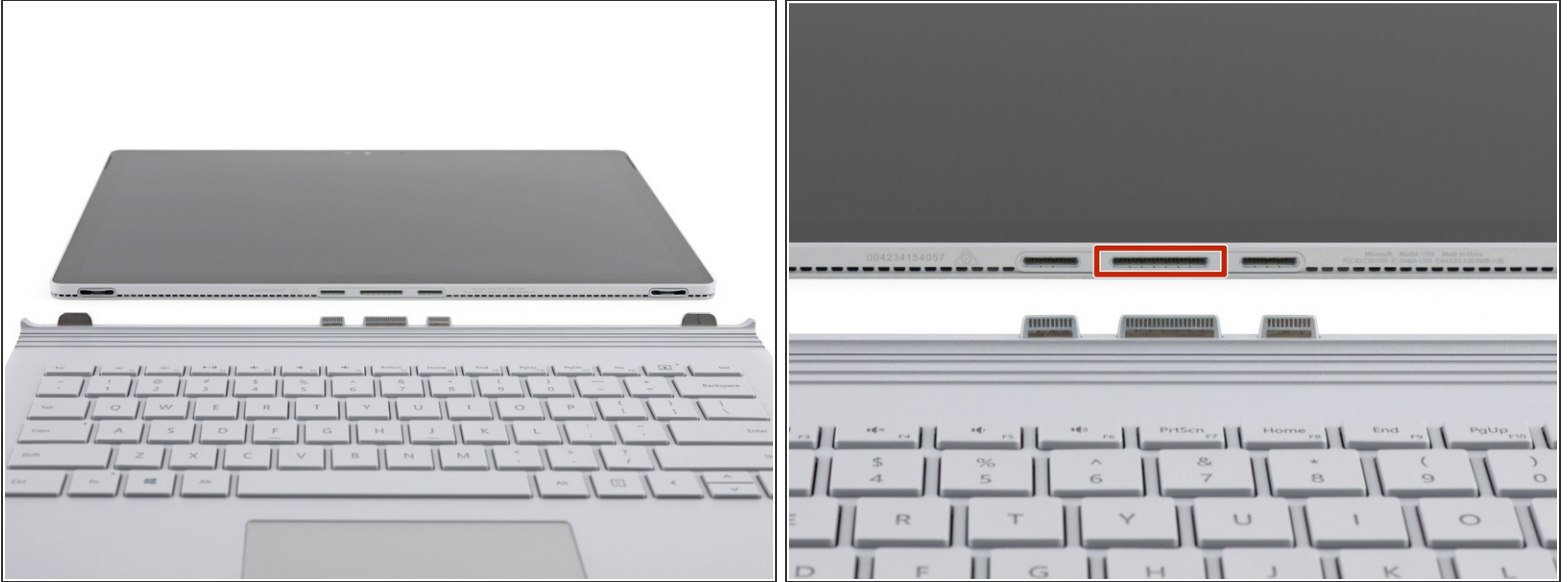
- The right edge of the Book's base houses a Mini DisplayPort socket and Microsoft's proprietary SurfaceConnect port.
  - ⓘ As an added bonus, the 3.5 mm headphone jack lives on the display, rather than the base, for your on-the-go audio needs—although we're a little confused by its placement at the *top* of the Book.
- On the left edge, we find two full-size USB 3.0 ports and an SD card reader.

## Step 3



- "Lift-off in T-minus 3...2... oh wait—the battery's low."  
⚠ With the battery dwindling, the Surface Book won't cooperate—forcing us to turn it off before we're, ahem, *allowed* to disconnect the display.
- What separates the Surface Book from the competition is the fact that (usually) you can separate it quickly, with minimal disruption to your work. Other devices tend to require you to power down *every time*.
- Now that we've achieved separation, we might as well reconnect it, but *backwards*!  
📌 Microsoft envisions the Surface Book being used like a "[creative canvas](#)" in this orientation.

## Step 4



- With the display disconnected from the base, we get a clear view of the Surface Book's docking connectors and teensy regulatory markings.
- The display uses the standard SurfaceConnect port to plug into the base, sipping power as needed.
  - ❗ Which also means you can charge the display's battery *sans*-base, in case you want to go board-free.

## Step 5



- Glancing over the top of the display, we're greeted by a [familiar](#) face.
- Like the Surface Pro 4, the Book's forward sensor array features an IR sensor, 5 MP camera, microphone, and ambient light sensor.
- Likewise, we find an 8 MP, 1080p camera and microphone combo on the rear of the display, matching the hardware on the back of the Surface Pro 4.

⚠ Crummy pun incoming: Guess we read Microsoft *like a book*.



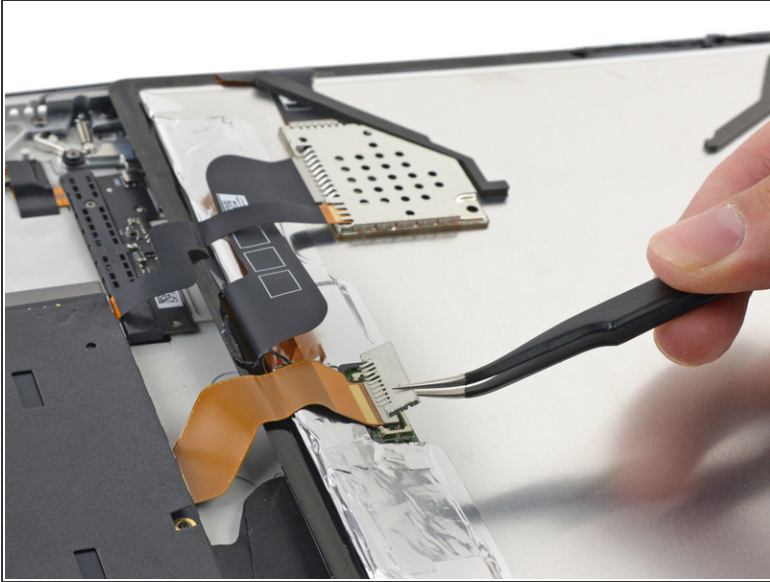
## Step 6



- We know our way past this display. It may be a bigger (and seemingly more flexible) pane of glass than we saw in the [Surface Pro 4 teardown](#), but it opens with the same password: *iOpener*.
  - The glass thickness measures in at 0.4 mm, the same as on the Surface Pro 4.
- i** Experience doesn't make it any less nerve-racking. The Surface line has come a long way, but we'd love to see an upgrade to their opening procedure. Maybe something that *doesn't* threaten to send glass shards flying at the slightest misstep...

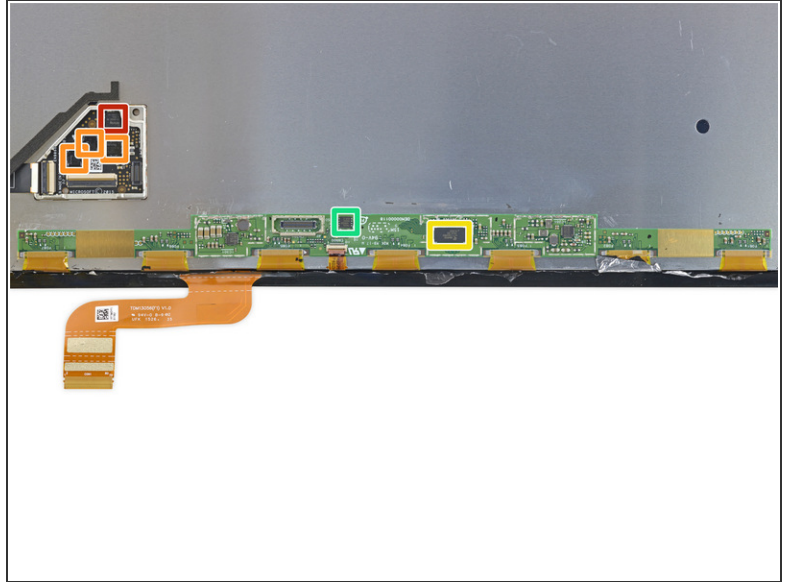


## Step 7



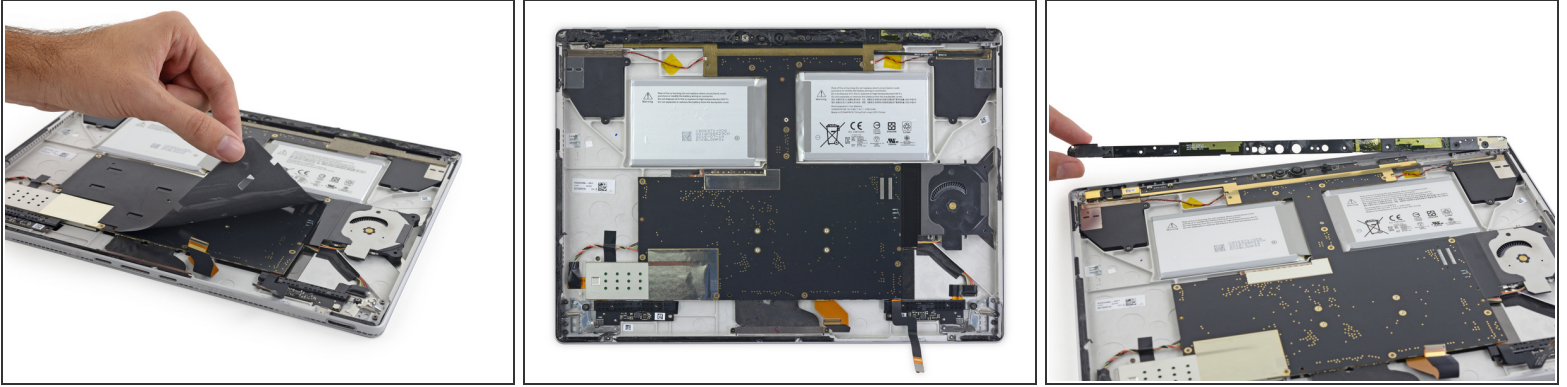
- Never one to judge a Book by its cover, we're glad for a chance to peek under the, um, lid.
- Right away, we notice two cables tethering the display to the motherboard. *Fortunately*, they're conveniently located along one edge—meaning we really *can* flip this thing open like a book—and we easily dispatch their press-on connectors.
- *Unfortunately*, these cables lead directly under the motherboard, which looks to be upside-down.
- We do get a look at a small fan channel, which pairs with matching foam on the back of the display to direct the air *just* so.
- ❗ The timing couldn't have been better—we're still a little heated about the motherboard situation and need to cool off.

## Step 8



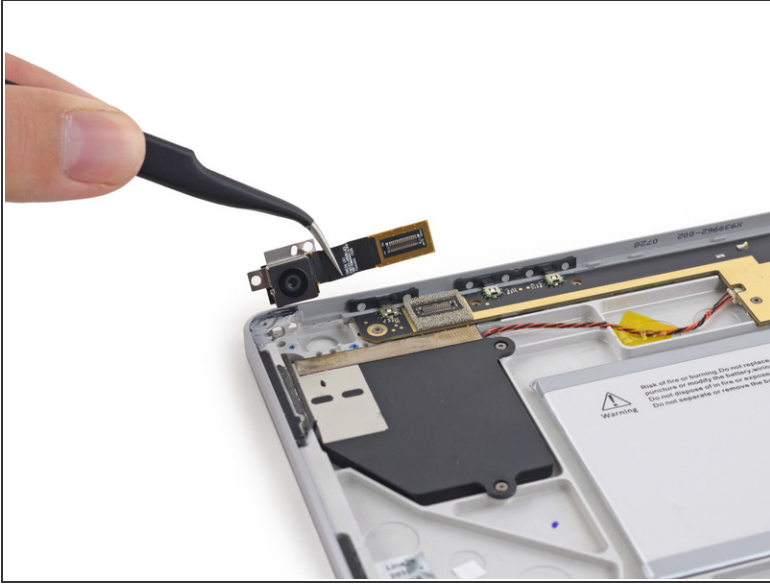
- Peeking out from beneath protective shielding, we find a chipset similar to that of the [Surface Pro 4 display](#):
  - N-trig DS-D5000 A0
  - N-trig DS-A5048 B2
  - Novatek NT71394MBG 1520-ED KLNAH
  - Macronix [MX25U4033E](#) 1.8 V 4.0 Mb Multi-in, Multi-out Serial NOR Flash Memory

## Step 9



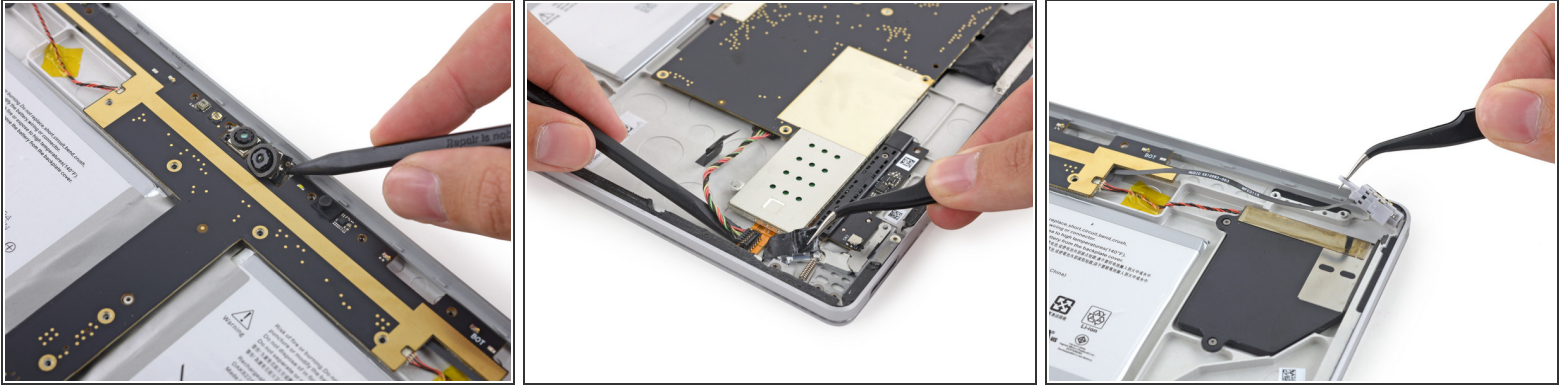
- Peeling up a thin foam layer confirms our suspicions—the motherboard is indeed upside down—smooth back up top, connectors and chips on the bottom.
- ❗ Our best bet about why this happened is that Microsoft wanted a smooth backing to support the large and rather flexible display.
- Surprisingly, said motherboard also sprawls throughout the entire chassis, resembling some kind of nightmarish [Tetris piece](#).
- What's more, there's no sign of connectors for any of the peripheral components.
- At least the camera bar comes up without any trouble. Maybe we'll find some tasty treasure below.

## Step 10



- While the rear-facing camera comes free without a fight, the rest of the sensor array crew is stuck doing some time behind (PCB) bars.
- Mugshots, from left to right:
  - Ambient light sensor
  - Infrared emitter
  - Infrared camera
  - Front-facing camera
  - "Privacy light" indicator LED
  - Microphone

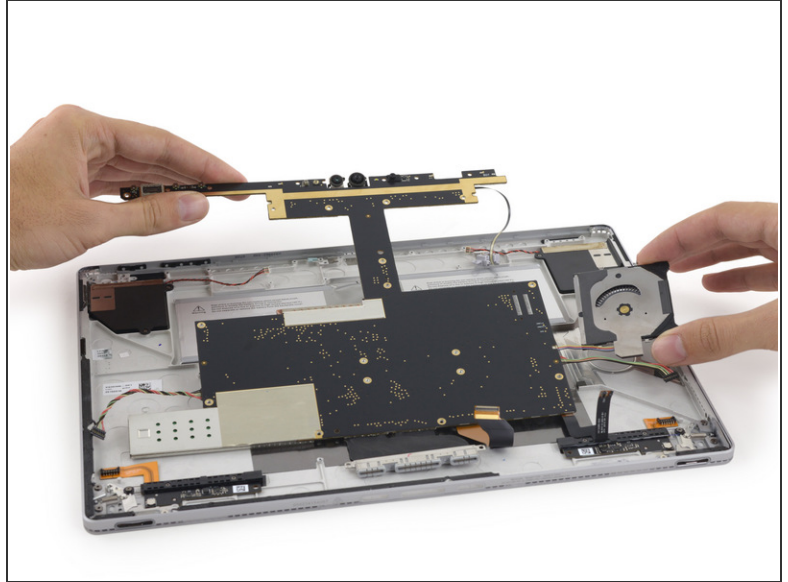
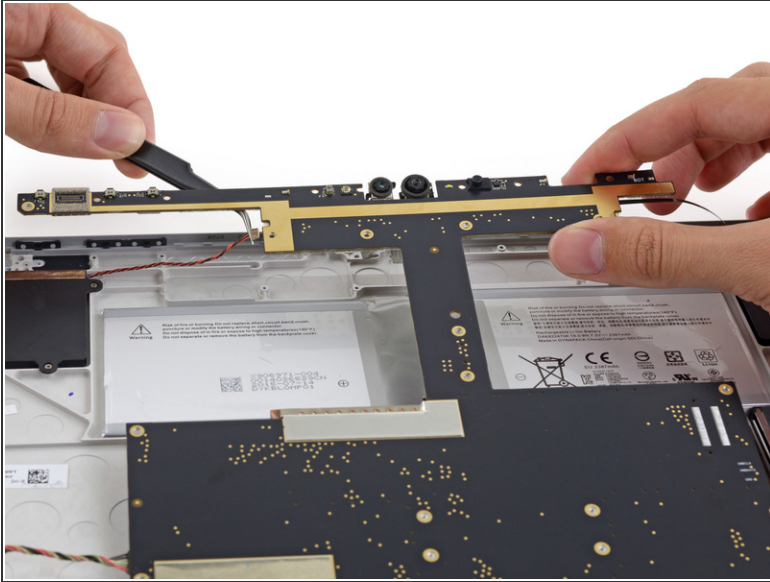
## Step 11



- It's time to begin some Surface *excavation*!
- The front-facing camera and IR sensor are glued to the chassis *and* trapped beneath the motherboard assembly, which makes for some tricky prying.
- Next, we tackle tons of troublesome tape and deftly disconnect a tangle of connectors.
- We arrive at the headphone jack, only to find that it's connected to the underside of the motherboard assembly by a lengthy cable.

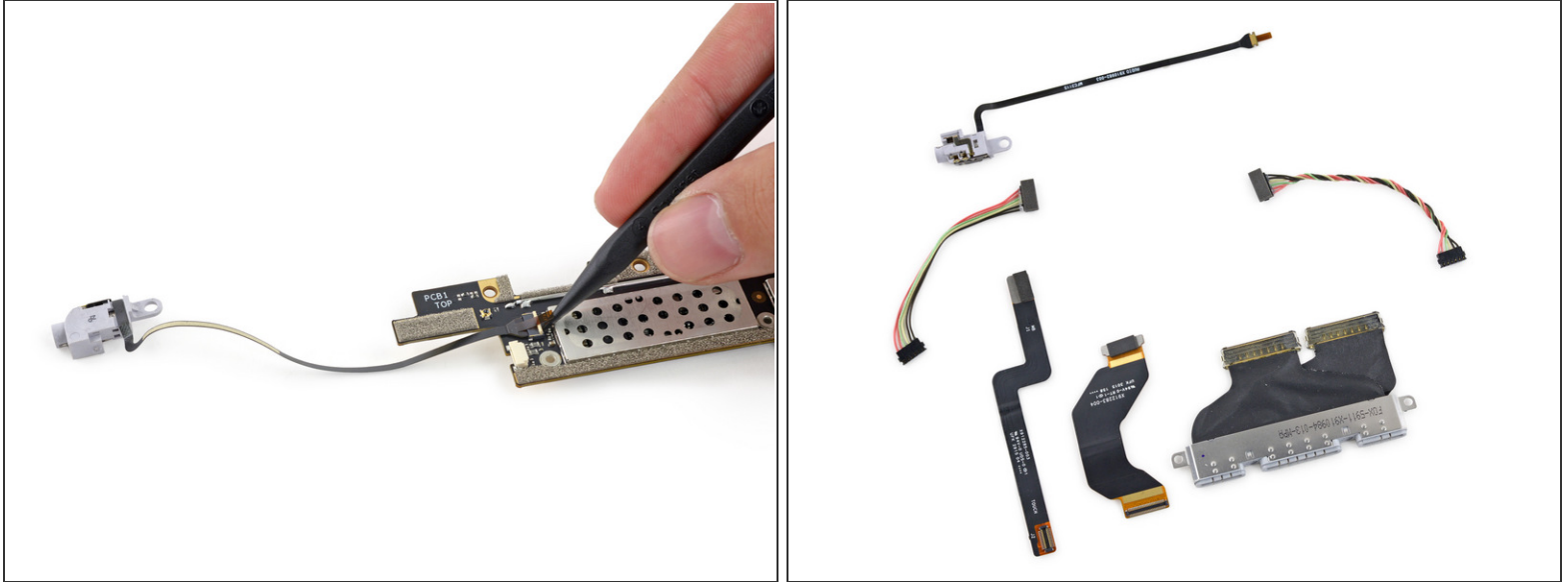


## Step 12



- Some finagling frees the speaker connectors, allowing us to lift and remove the nightmare of a motherboard assembly.
- ❗ This is a motherboard only a mother could love...

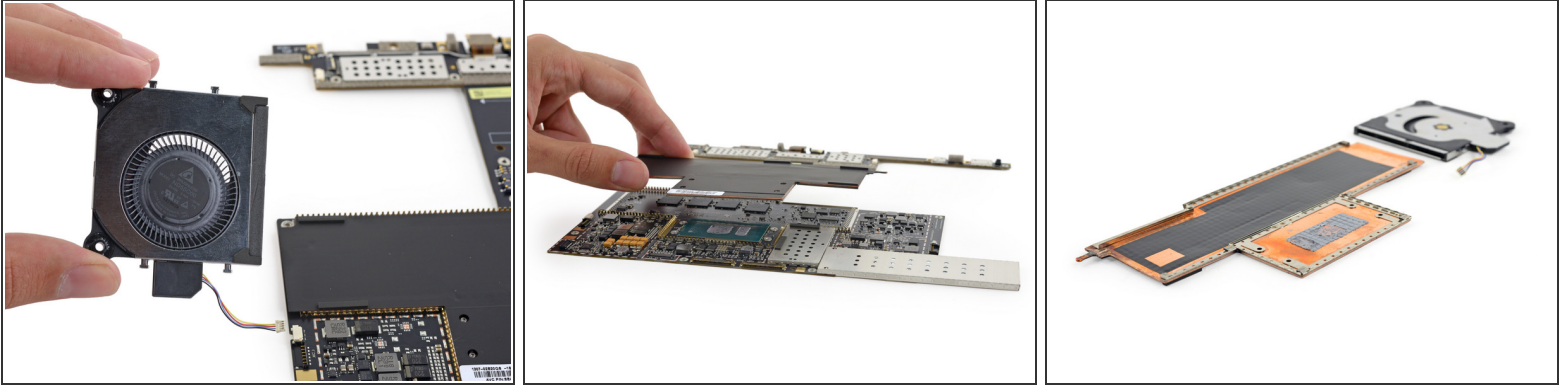
## Step 13



- Prepping the motherboard for its glamor shot, we begin the arduous task of removing cables. *Soo* many cables.
- ⓘ Modular construction means that replacing any particular interconnect cable will be cheaper, but a (more common) motherboard replacement will be a bit time-consuming.



## Step 14



- With the motherboard sunny side up, we take a moment to pull out its brushless, 0.5 Amp fan.
- Eager to get a taste of that sweet, sweet silicon, we also relieve the motherboard of its sprawling heat sink.
- The cooling system in the Surface Book bears a passing resemblance to the large copper plate tucked against the battery of the [Surface Pro 4](#), but covers *silicon* instead of Li-ion.
- ❗ The display features a single oversized heat pipe, forming the top of a duct that uses the fan to pull heat away from the processor and major on-board components.

## Step 15



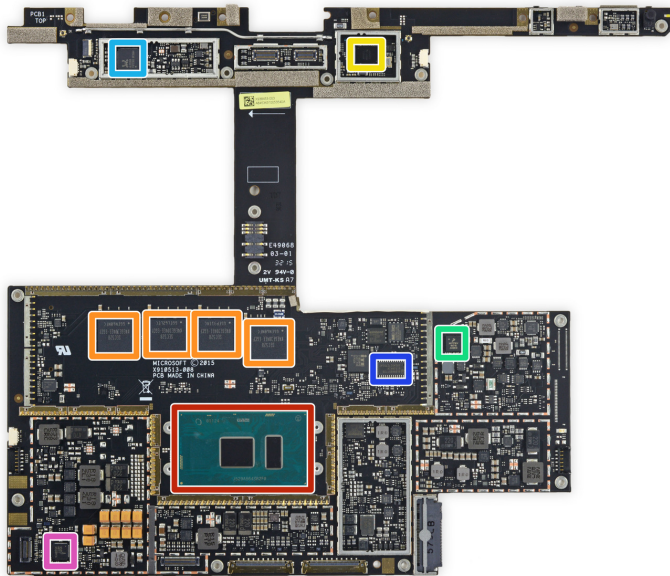
- Having done their time, the front-facing and infrared cameras are plucked from their prison by a pair of our favorite [tweezers](#).
- Grateful for our assistance, they agree to pose for a couple of shots.
  - The infrared camera (on the left) is used for facial recognition for [Windows Hello](#).
  - The 5 MP camera to the right is perfect for your everyday selfie needs.

## Step 16



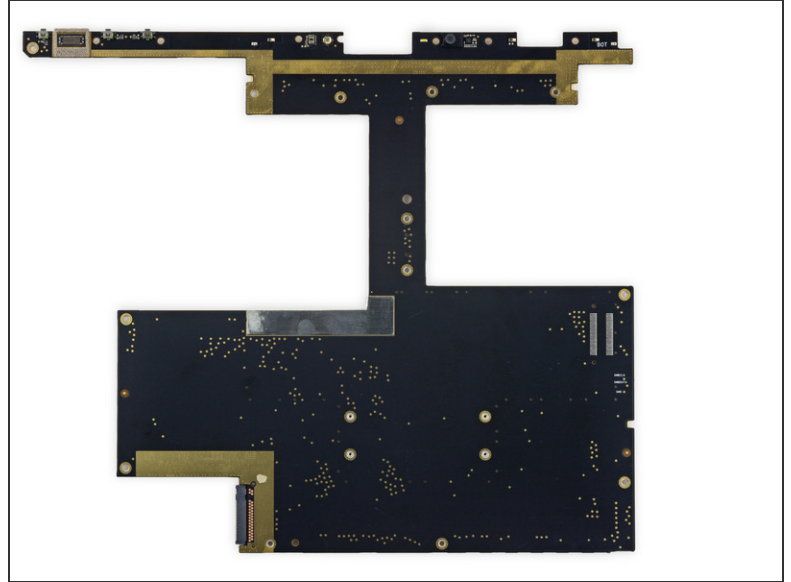
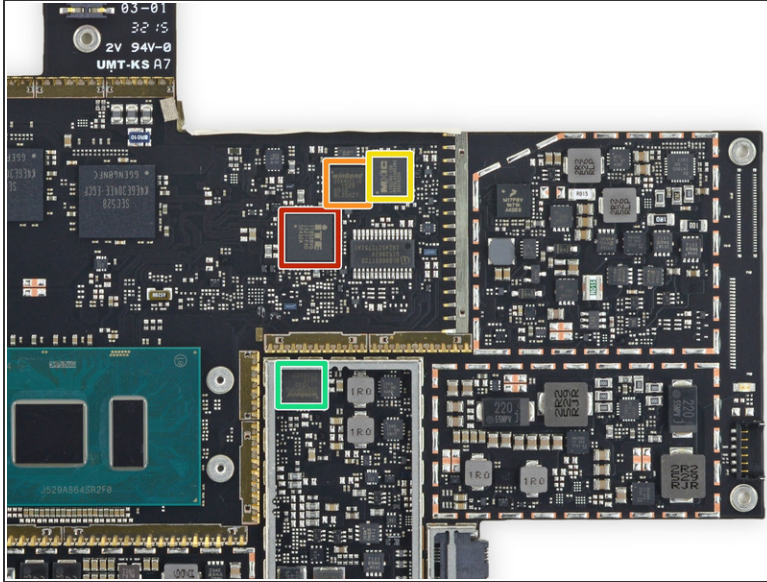
- We're on the home stretch—all that stands between us and total motherboard liberation is the 128 GB Samsung [PM951](#) SSD.
- This memory module is giving us feelings of déjà vu—it's identical to the one we found in the [Surface Pro 4](#) (although, unlike in the Pro, this aluminum SSD tray is literally just taped to the back of the motherboard):
  - Samsung [S4LN058A01](#) PCIe 3.0 x4 NVMe flash controller
  - Samsung K9CHGY8S5C 64 GB NAND Flash
  - Samsung [K4E4E324EE](#) 4 Gb (512 MB) DRAM
  - Texas Instruments [TPS22966](#) 5.5V, 6A, 16mΩ, 2-Channel Load Switch

## Step 17



- Finally a bare logic—err, motherboard. That black PCB à la Steve Jobs had us confused for a second.
- Intel [SR2F0](#) Core i5-6300U Processor (3M Cache, up to 3.00 GHz)
- Samsung [K4E6E304EE-EGCF](#) 16 Gb LPDDR3 1867 MHz SDRAM (4 chips for a total of 8 GB)
- Marvell Avastar [W8897](#), likely Wi-Fi/Bluetooth combo chip
- Freescale Kinetis KL17 [MKL17Z256VFM4](#) 48 MHz [ARM Cortex-M0+](#)
- Realtek ALC3269 Audio Codec
- Infineon Technologies [SLB9665TT20](#) Trusted Platform Module
- Intersil [ISL95857](#) 1+2+1 Voltage Regulator for Intel IMVP8 CPUs

## Step 18



● But wait, there's more!

- ITE IT8528VG
- Winbond [W25X40CL](#) Serial Flash Memory
- Macronix [MX25L4006E](#) 3V, 4 Mb [x 1/x 2] CMOS Serial Flash Memory
- Winbond [W25Q128FV](#) 128 Mb Serial Flash Memory

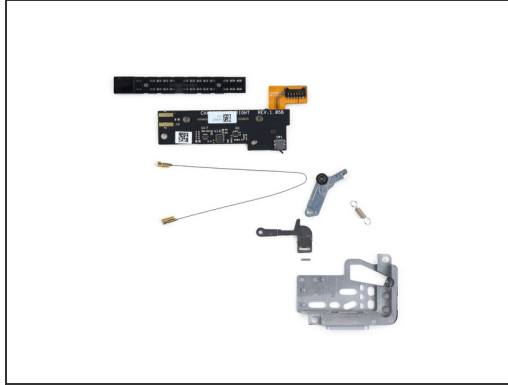
🔍 On the back (front?) we find a handful of sensors, and some cryptic labels, but not a lot else...

## Step 19



- The Book's display battery is actually *easier* to remove than the [cell](#) in the Surface Pro 4.
  - ❗ This is likely due to the fact that it's smaller and has less surface area—i.e. less adhesive.
- While the Surface Book is intended to be used while docked, its display packs a 18.0 Wh, 7.5 V, 2387 mAh battery and an alleged [four hours](#) of battery life.
- Judging by the [Surface Pro 4](#)'s 38.2 Wh battery, and the [iPad Air 2](#)'s 27.62 Wh, we expect to find a decent cell in this Book's base to meet the [spec'd](#) 12 hour battery life.
  - ★ After all, 3000 x 2000 pixel displays have a habit of using a lot of power.

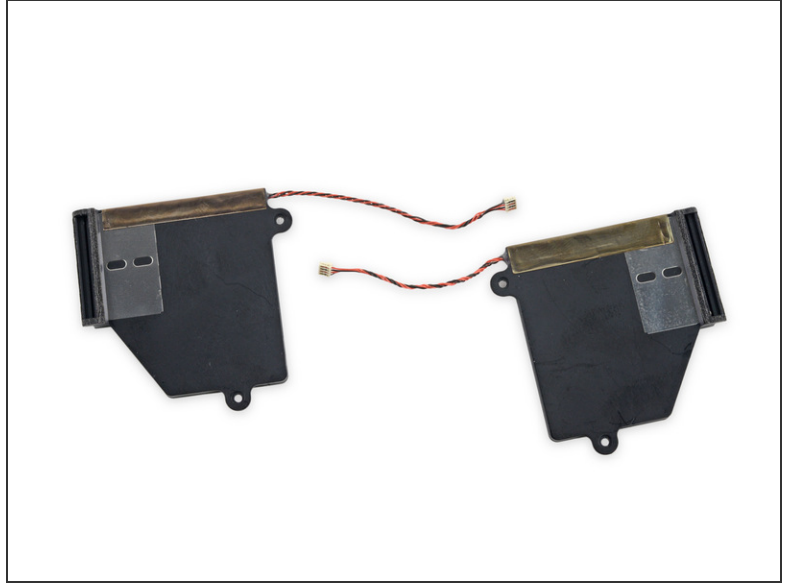
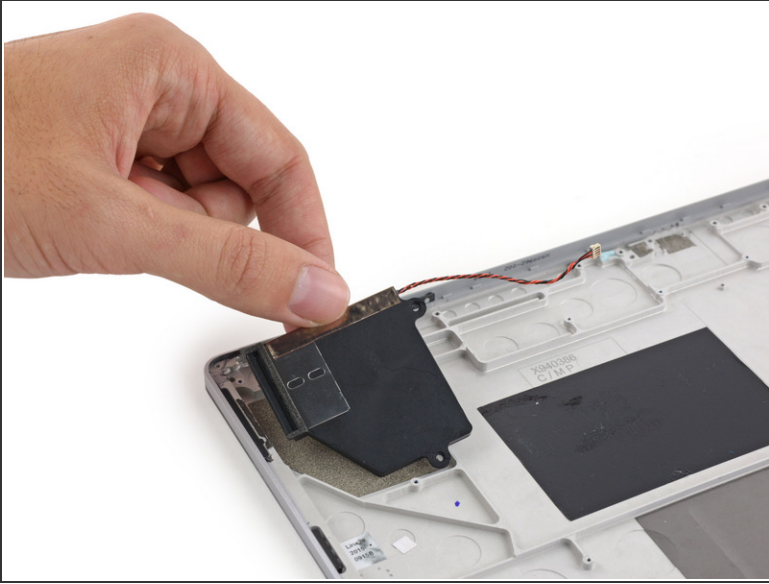
## Step 20



- The Surface Book features a "Muscle Wire Lock," that will keep your display securely fastened to the base, until it's time to undock and get more mobile.
- ⓘ Muscle wire is one of many names for [shape-memory alloy](#), a class of materials that can undergo deformation, and then return to a prior shape when heated.
  - In this case, electricity is run through the wire, heating it up and causing it to contract. This pulls the black pulley inward, against the spring, lifting the lower arm of the linkage.
  - That lower arm holds a very tiny rod captive. The rod serves as the grip, that holds onto the base unit's metal tab. When the linkage is retracted, the rod rolls out of the way and lets the base go.

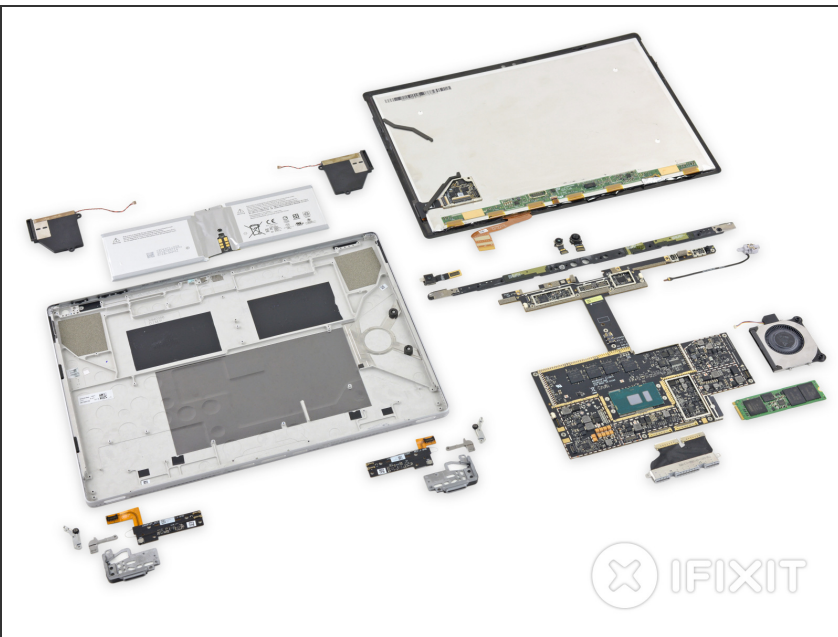


## Step 21



- We're curious about the *state* of the audio components, so we extract the Book's [Nevada](#)-shaped speaker for closer inspection.
- Of course, our stately speaker has a twin: nega-Nevada. Thankfully, there's no tiny [goatee](#) to suggest it's an evil twin.

## Step 22



- ❗ Cue the intermission music! We're halfway through this Book, but we can hardly wait for chapter two!
- Enjoy this initial layout, but the base-  
t is yet to come!
- The *best*... the *base*... You get it?  
Yeah?



## Step 23



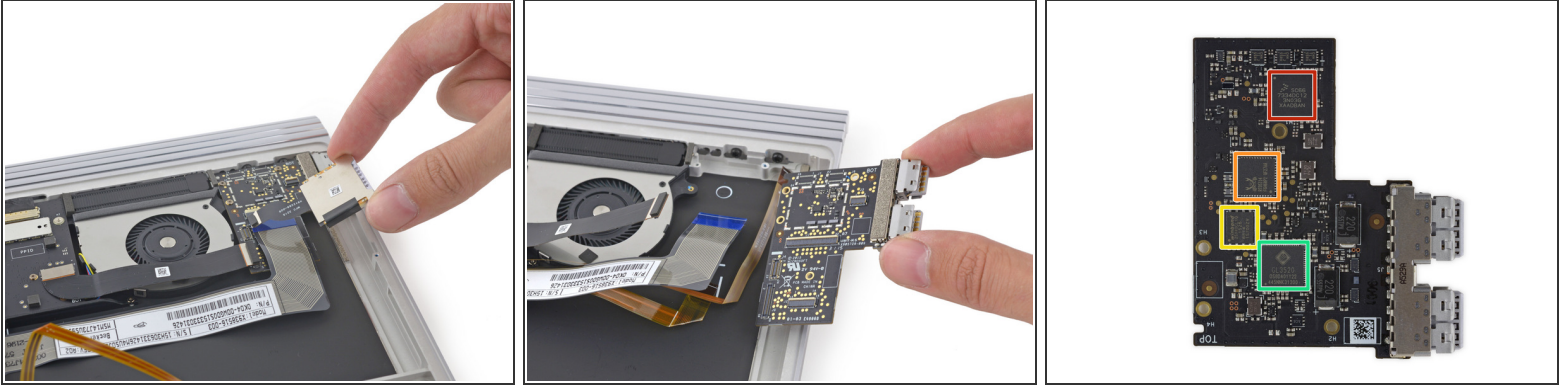
- Enough fun with the top bit, let's get back to basics, and tear into this base.
- The lower case sits smooth and flush, with a very thin gap. We know what that means—time to warm the iOpener back up and get ready to pry.
- While we wait for the [iOpener](#) to do its thing, we do our due diligence and peel up those two wide rubber feet. And find channels for wide rubber feet. Alas, no screws.

## Step 24



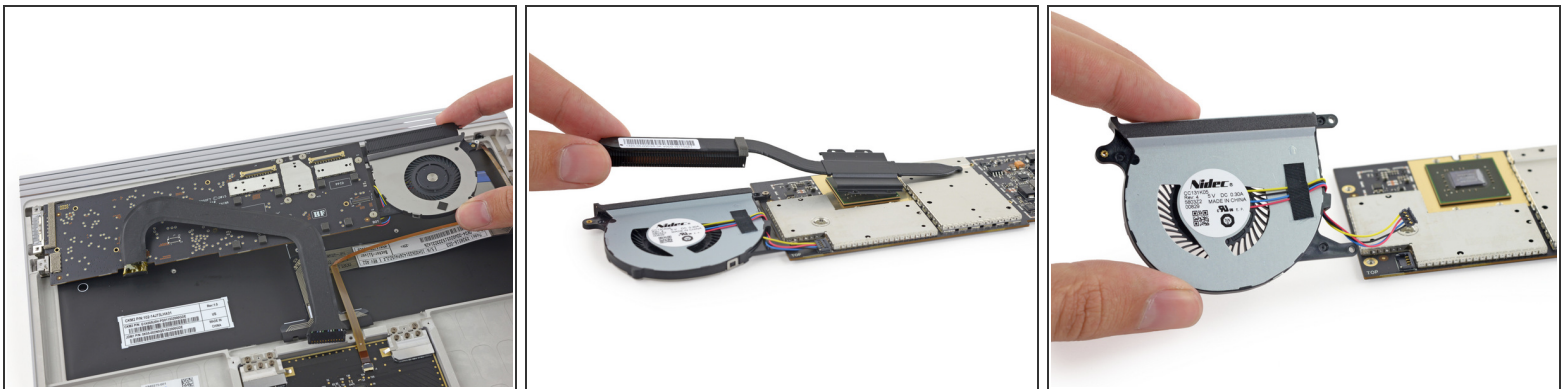
- After some intense heating and very arduous prying, we finally get past the hefty adhesive holding the lower panel.
- Surprise! The battery comes right off with the lower panel à la [Retina MacBook](#).
- With the power disconnected, let's get a closer look at this, the real power behind the Surface Book. With 51 Wh (6800 mAh at 7.5 V), the base battery provides nearly *3 times* the juice as the tablet.
- Both batteries combined give us 69 Wh, just a mite shy of the 74.9 Wh you'd get in this year's [13" Retina MacBook Pro](#).

## Step 25



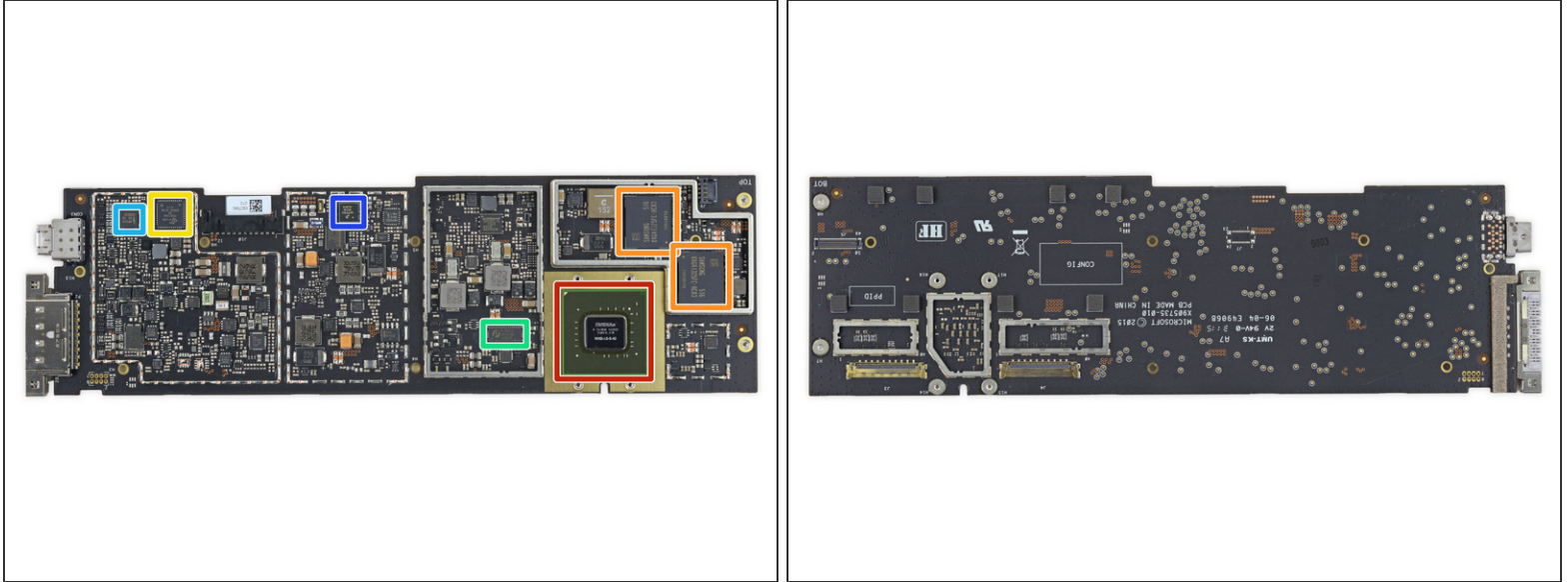
- First out of this tiny ~~MaeBook~~ base is an SD reader, blocking access to the I/O board.
  - Well, that and a nest of cables.
- At last the board is free. Here's what it's packing:
  - Freescale SC66 7334DC12
  - Realtek RTS5314 SD Card Reader Controller
  - Winbond [25X40CLIG](#) Serial Flash Memory
  - Genesys Logic [GL3520](#) USB 3.1 Hub Controller

## Step 26



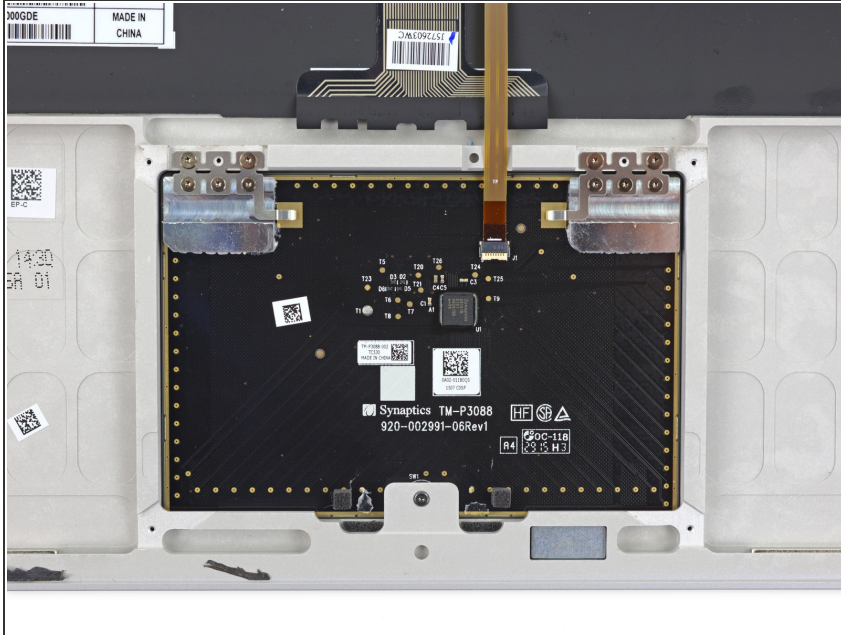
- Appetite whetted, we pluck out the Book's GPU board assembly and its attached fan.
- We find a suspiciously Mac-like heat sink mounted to the base's GPU.
  - ❗ Wow, this is *really* giving off an Apple vibe.
- We've always said we could use a few more fans. With the heat sink out of the picture, the base's 0.30 Amp model is ours for the taking.
  - That would have been a lot of work just to clean a dusty fan. Let's hope *that* never happens.

## Step 27



- Finally we reach the bottom of the stack and get a look at that fancy dedicated GeForce GPU. This is a custom job, that the internet has deduced is about on par with a [GeForce 940M](#).
  - Nvidia N16S-LG Custom GeForce GPU
  - Samsung [K4G41325FC](#) 512 MB GDDR5 Graphics RAM (1 GB total)
  - Parade [PS8330B](#) Dual-Mode DisplayPort Version 1.2 Repeater
  - Pericom [PI3PCIE](#) PCIe Switch/Multiplexer
  - NXP [CBTL06GP213EE](#) Six-Channel Multiplexer for DisplayPort, HDMI and PCI Express
  - Freescale Kinetis [KL17](#) 48 MHz ARM [Cortex-M0+](#) Microcontroller

## Step 28



- For those of you keeping track at home, we have a touchdown!
- Our screwdriver has scored six points of entry on either side of this Synaptics trackpad—er, five points? It looks like there is an empty space where a screw should be on either side. Interesting...
- We make a beeline to tackle the single remaining screw on the bottom of the trackpad, punt the trackpad connector, and head for the goal (or at least a place with fewer sports metaphors).

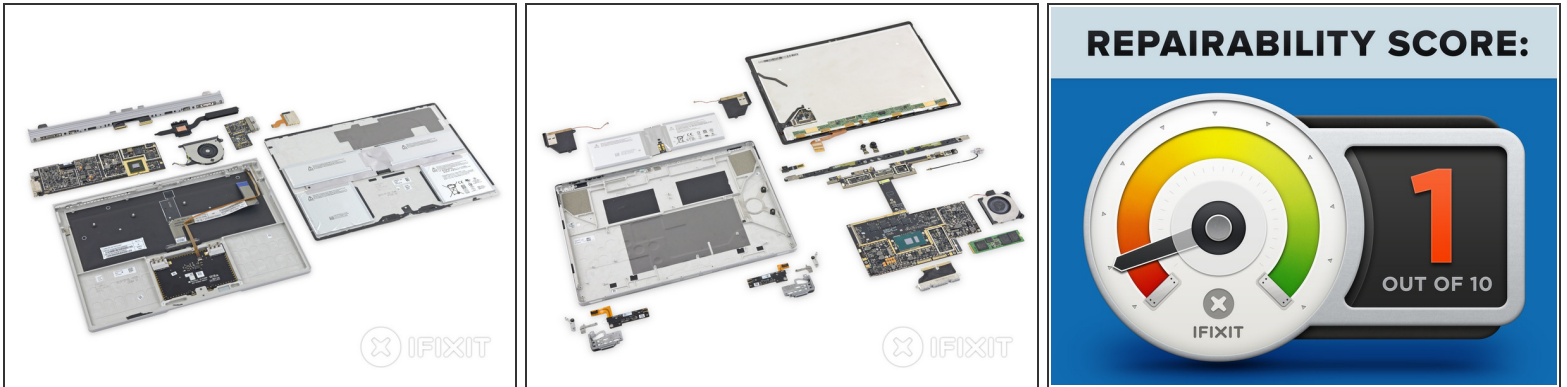
## Step 29



- Now it's time to get twisted and unhinged.
- We spin a handy [Torx precision driver](#) to free the segmented hinge from the base.
- The cables slide free of their basic home fairly easily, but then disappear into the spine of the hinge...
- The segments are secured with various screws, so hinge, spine, and cables are likely replaceable, should they wear out.



## Step 30



- All your base are belong to us. But don't worry you get a cool layout out of it!
- The Microsoft Surface Book (as a whole) earns a reparability score of **1 out of 10** (10 is easiest to repair).
  - After the difficult opening procedure, the SSD can be replaced. So too the glued battery in the display. However, the base battery is very heavily glued.
  - The display assembly consists of a fused glass panel and LCD, and is difficult to remove and replace.
  - The processor and RAM are soldered to the motherboard.
  - Strong adhesive holds many components in place, including the display, base cover, and both batteries.
  - Many components are on the backs of their respective boards, requiring motherboard removal to replace simple components.

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